Fiscal Year:	FY 2012	**Task Last Updated:**	FY 02/07/2012
PI Name:	Rajulu, Sudhakar Ph.D.		
Project Title:	Spinal Elongation and Its Effects on Seated Height in a Microgravity Environment		
Division Name:	Human Research		
Program/Discipline:	HUMAN RESEARCH		
Program/Discipline--Element/Subdiscipline:	HUMAN RESEARCH--Space Human Factors Engineering		
Joint Agency Name:		**TechPort:**	No
Human Research Program Elements:	(1) **SHFH**:Space Human Factors & Habitability (archival in 2017)		
Human Research Program Risks:	(1) **HSIA**:Risk of Adverse Outcomes Due to Inadequate Human Systems Integration Architecture		
Space Biology Element:	None		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
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PI Organization Type:	NASA CENTER	**Phone:**	281-483-3725
Organization Name:	NASA Johnson Space Center		
PI Address 1:	Code SF3		
PI Address 2:	2101 NASA Pkwy		
PI Web Page:			
City:	Houston	**State:**	TX
Zip Code:	77058	**Congressional District:**	22
Comments:			
Project Type:	FLIGHT	**Solicitation / Funding Source:**	Directed Research
Start Date:	12/11/2007	**End Date:**	10/01/2011
No. of Post Docs:		**No. of PhD Degrees:**	
No. of PhD Candidates:		**No. of Master' Degrees:**	
No. of Master's Candidates:		**No. of Bachelor's Degrees:**	
No. of Bachelor's Candidates:		**Monitoring Center:**	NASA JSC
Contact Monitor:	Perchonok, Michele	**Contact Phone:**	(281) 483-7632
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Flight Program:	Shuttle/ISS		
Flight Assignment:	ISS 20, ISS 21, ISS 22, ISS 23, ISS 24, ISS 25, ISS 26 STS-128, STS-129, STS-130, STS-132, STS-133, STS-134 NOTE: End date should be 10/1/2011, per E. Connell/JSC (Ed., 9/16/2011) NOTE: Start date should be 12/11/2007 (from 6/02/2008) per B. Woolford/S. Steinberg-Wright/JSC (5/19/2009) NOTE: End date should be 06/30/2012 (from 9/30/2011) per B. Woolford/S. Steinberg-Wright/JSC (4/17/2009) NOTE: End date corrected to 9/30/2011 (from 9/30/2010) per S. Steinberg-Wright/JSC (4/2009)		
Key Personnel Changes/Previous PI:	Miranda Mesloh is no longer a Co-Investigator.		
COI Name (Institution):	Young, Karen (Lockheed-Martin / NASA Johnson Space Center)		
Grant/Contract No.:	Directed Research		
Performance Goal No.:			
Performance Goal Text:			

Task Description:	The primary objective of this project is to provide information pertaining to changes in seated height due to spinal elongation in a microgravity environment. The proposed experiment aims to collect seated height data for subjects exposed to microgravity environments, provide information relating to seated height rate of change over time, and feed new information regarding the impact of elongation upon seated height into the design of Constellation systems. Historical data indicates that spinal elongation occurs when crewmembers are subjected to microgravity. As a result, in as little as two days, the typical crewmember will exhibit increases in stature of up to 3 percent. However, spinal elongation impact data has been collected only for crewmembers in standing postures, and that too, from a limited pool of subjects. Due to the criticality of seated height in the design of the Crew Exploration Vehicle (CEV), a better understanding of the effects of microgravity/spinal elongation on seated height is necessary. Small changes in seated height that may not have impacted crew accommodation in previous programs will have significant effects on crew accommodation due to the layout of seats in the CEV. The proposed study will directly measure changes in seated height for crewmembers in the Shuttle cockpit. An anthropometer will be used to record measurements to the top of the head of a seated subject, and an orthogonal photograph will be taken in order to measure seated height based on scaling references of known sizes as well as verify the posture and positioning remained consistent throughout the study. Data gained from this study will provide better information to CEV designers. Accurate measurements of crew seated height growth will be valuable for vehicle and habitation designers for future programs as well. See also https://
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	This study will provide information on spinal elongation and how space flight will affect accommodation and design requirements. This information may also be useful for people who suffer from back pain and back compression on Earth.
Task Progress:	During the FY11, this project was able to complete data collection during two Shuttle flights for a total of 29 participants for the conclusion of the study. Thirty-two subjects consented to participate in the spinal elongation experiment, including ISS backup crewmembers. Two subjects were not able to participate during their mission due to Shuttle launch date slips. The PI team was able to achieve the total number of subjects for this experiment during this fiscal year. The PI team was able to analyze the results of seated height growth as well as stature growth which was an optional measurement for the participants. A final report and corresponding memos were generated and submitted as part of the project's milestones to inform stakeholders of the spinal elongation results and to update all requirement documents as necessary. The pre-flight, in-flight, and post-flight data was used to determine results for the change in seated height due to microgravity.
Bibliography Type:	Description: (Last Updated: 03/25/2020)
Abstracts for Journals and Proceedings	Young K, Rajulu S. "Effect of microgravity on seated height: preliminary results." 18th IAA Humans in Space Symposium, Houston, TX, April 11-15, 2011. 18th IAA Humans in Space Symposium, Houston, TX, April 11-15, 2011. , Apr-2011
Articles in Peer-reviewed Journals	Young KS, Rajulu S. "Changes in seated height in microgravity." Appl Ergon. 2020 Feb;83:102995. Epub 2019 Nov 15. https://doi.org/10.1016/j.apergo.2019.102995 ; PubMed PMID: 31739138 , Feb-2020